Utah Diabetes Practice Recommendations

Management of Children and Adolescents with Diabetes

Section 4 in a series of topics included in the Utah Diabetes Practice Recommendations

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Diabetes Prevention & Control Program
UTAH DEPARTMENT OF HEALTH

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Abbreviations used in this document:

BG = blood glucose, roughly equivalent to plasma glucose; used in this document as a general term and for values obtained with home meters (although the home meter the patient uses will likely report plasma glucose values)
PG = plasma glucose; used in this document in specific relation to a laboratory test that measures the amount of glucose in plasma, rather than that in whole blood
FPG = fasting plasma glucose test
RPG = random plasma glucose (also referred to as "casual glucose") test
PPG = postprandial plasma glucose test
SMBG = self- monitoring of blood glucose
FBG = fasting blood glucose, especially the pre-breakfast SMBG value

This UDPR is a model of best care based on the best available scientific evidence and the opinion of experts. It's not a prescription for every physician or every patient, nor does it replace clinical judgment.

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Management of Children and Adolescents with Diabetes

INTRODUCTION

To aid health care providers, the Utah diabetes Prevention and Control Program (DPCP) organized a committee of healthcare professionals to develop a new Utah Diabetes Practice Recommendation (UDPR). This UDPR focuses on diabetes management of children and adolescents. Children have characteristics that require different needs in their diabetes care such as age, size, and mental maturity. This UDPR is intended to provide outlines for screening, diagnosis, and appropriate diabetes management. The content of the UDPR follows national and regional guidelines.

The growing prevalence of diabetes has led to an increased demand in the number of medical providers having expertise in the treatment of patients with diabetes. For a variety of reasons, primary care providers are absorbing a larger proportion of patients with diabetes. The time constraints faced by primary care providers are well recognized and in their need to keep current on the changing protocols, they face additional time constraints. This need to keep current places a tremendous burden on primary care providers as they work to provide optimal care for their patients with diabetes. This new UDPR is to be used to aid providers and help stay up to date on current practice recommendations.

PEDIATRIC DIABETES

PREVALENCE – Diabetes is one of the most common chronic diseases in children. In the United States, about 150,000 people under 18 years of age have diabetes. About 1 in every 400 to 500 children has type 1 diabetes. About 75 percent of all newly diagnosed cases of type 1 diabetes occur in individuals younger than 18 years of age. Each year, more than 13,000 children are diagnosed with type 1 diabetes.

It is hard to detect type 2 diabetes in children because it can go undiagnosed for a long time; because children may have no symptoms or mild symptoms; and because blood tests are needed for diagnosis. It is difficult to be sure it is type 2 because criteria for differentiating between types of diabetes in children is confusing; that is, children with type 2 can develop ketoacidosis (acid build-up in the blood); children with type 1 can be overweight; and because the overall prevalence of the disease may still be low. However, health care providers are finding more and more children with type 2 diabetes. Currently, because 10 to 15 percent of children and teens are overweight – about double the number of two decades ago – increasing numbers of young people have type 2 diabetes. The epidemic of obesity and the low level of physical activity among young people, as well as exposure to diabetes *in utero*, may be major contributors to the increase in type 2 diabetes during childhood and adolescence.[1]

COST – National estimates of healthcare expenditures for a person with diabetes are more than five times higher than persons without diabetes. In 2002, direct and indirect costs of diabetes in the United States were $132 billion, $40 billion in indirect costs (disability, work lost, premature mortality). In addition, 11 percent of national health care expenditure went to diabetes care. Though these figures reflect all people with diabetes, children and adolescents make up a significant amount.[1]

TREATMENT GOALS

- Receive adequate, age-appropriate, diabetes education (including the patient's family)
- Meet the Hemoglobin A1C (HbA1C) values:
    - <6 years old = 7.5 – 8.5%
    - 6-12 years old = <8%
    - 13-19 years old = <7.5%
- Meet routine care and follow-up recommendations based on the guidelines discussed in this document. These include:
    - HbA1C measurement and growth monitoring
    - Regular screening for associated long-term complications
    - Regular screening for autoimmune disorders
    - Routine screening for mental health disorders
- Have a quarterly visit with diabetes provider and diabetes team or as needed

SCHEDULE AT A GLANCE

The following chart summarizes recommended tests, frequency, and target values.

<table>
<tr><th></th><th>Asses /Screen for</th><th>Test(s)</th><th>How Often</th><th>Target Value</th></tr>
<tr><td>ROUTINE PEDIATRIC CARE</td><td>“Well child” or “well” visit</td><td>Age-appropriate:
o Physical exam
o Screening tests
o Immunizations
o Developmental assessment</td><td>Annually</td><td></td></tr>
<tr><td rowspan="2">ROUTINE DIABETES CARE
blood glucose and growth monitoring</td><td>Blood glucose control</td><td>o HbA1C
o Review of SMBG records</td><td>At every office visit or at least 4 times a year</td><td>See below</td></tr>
<tr><td colspan="3"><table>
<tr><td>Ages</td><td>HbA1C: type 1</td><td>BG before meals</td><td>BG bedtime /overnight</td></tr>
<tr><td>< 6 yrs</td><td>7.5 to 8.5%</td><td>100-180 mg/dL</td><td>110-200 mg/dL</td></tr>
<tr><td>6-12 yrs</td><td><8%</td><td>90-180 mg/dL</td><td>100-180 mg/dL</td></tr>
<tr><td>13-19 yrs</td><td><7.5%</td><td>90-130 mg/dL</td><td>90-150 mg/dL</td></tr>
</table></td></tr>
<tr><td>Normal growth</td><td>o Height, weight plotted on a growth chart
o BMI</td><td>At every office visit or at least 3 times a year</td><td>- Normal growth projection
- BMI <85% of normal for age</td></tr>
<tr><td rowspan="5">ROUTINE SCREENING
For long-term complications and co-morbidities</td><td>Retinopathy</td><td>Dilated eye exam</td><td>Annually, beginning at age 10</td><td>Normal</td></tr>
<tr><td>Neuropathy</td><td>Neurology foot exam using a 5.07 monofilament, or a tuning fork</td><td>Annually, beginning at puberty</td><td>Normal</td></tr>
<tr><td>Nephropathy</td><td>Microalbumin/ creatinine ratio

OR

First AM Void</td><td>Beginning at age 10 with diabetes duration of 2 or more years.
Annually thereafter</td><td>Microalbumin/creatinine ratio <30</td></tr>
<tr><td>Hypertension</td><td>Blood Pressure (BP)</td><td>At every office visit or at least annually</td><td>Systolic BP or Diastolic BP <90th percentile for age, sex, and height</td></tr>
<tr><td>Dyslipidemia</td><td>Fasting lipid profile</td><td>For patients <10 years, at diagnosis once glucose control is achieved AND if family history of hypercholesterolemia, CV event <55 yrs, or is unknown; then every 5 years

For patients >10 years, at diagnosis once glucose control is achieved; then every 5 years</td><td>LDL <100 mg/dL</td></tr>
</table>

	Asses/Screen for	Test(s)	How Often	Target Values
ROUTINE SCREENING for autoimmune disorders	**Celiac disease**	**Tissue transglutaminase antibody (TTG G)**	For type 1 only: **At diagnosis** once glucose control is achieved, and then **every 3-5 years** or more frequently as indicated per growth rate or symptoms	Age <2 yr: <5 units Age 2-19 yr: <7 units
	Thyroid disease	**TSH**	For type 1 only: **At diagnosis** once glucose control is achieved, and then **at least every 3-5 years**	Normal
MENTAL HEALTH SCREENING and CONTINUTING EDUCATION	**Mental health disorders** (including depression, eating disorders, etc.)	**2-question depression screen:** 1. Are you feeling down, depressed, or hopeless? 2. Have you lost interest or pleasure in doing things?	**At least annually** or more often as needed	If answer to either question is positive, or if you still suspect a mental health disorder, assess further If there were a chronic mental health disorder documented, person with diabetes and family would be referred to a mental healthcare professional
	Ongoing patient and family education, including self-management, medical nutrition therapy, and family support	**Initial education**	**Within 3-5 days of diagnosis**, with a 2 week follow-up visit	Patient and family demonstrates developmentally and age-appropriate understanding and proficiency at self-management
		Ongoing education	**At least annually**	

MANAGEMENT DURING INTERCURRENT ILLNESS

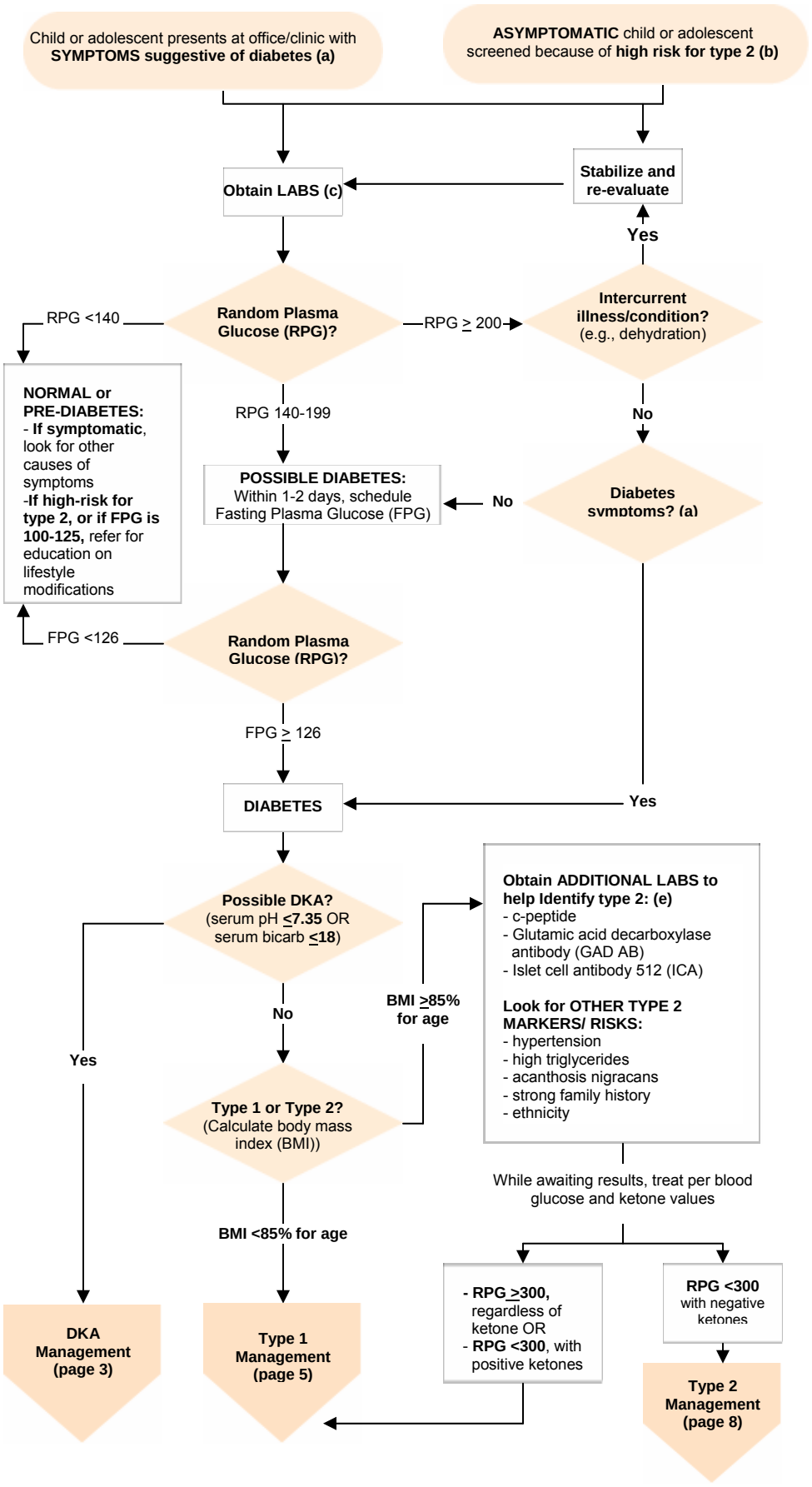
Sick day guidelines for patients

- **Check blood glucose more often**—about every 3 hours when you are sick
  - **Target blood glucose during illness should be 100-200 mg/dl**
- **Check ketones at least 2 times a day**
  - **Ketone testing method**. Urine test strips have been more commonly used, but blood ketone testing is recommended as a more accurate reflection of current ketosis. At-home blood ketone testing can now be done with some blood glucose meters. In the ideal setup, the family uses one meter for normal SMBG, reserving a second meter for blood ketone testing as necessary. (This eliminates the need to change out test strips and recalibrate the meter when switching between glucose and ketone testing.)
- **Drink plenty of fluids**.
- **Keep taking insulin while sick (unless told otherwise by provider).** Adjustments may be necessary.

Urine ketones	Blood ketones	Specific instructions for eating/drinking, insulin adjustments, and medical care
No ketones	Below 0.6 mmol/l is in the normal range	o **If blood glucose is below 80 mg/dL**, have some hard candy, popsicles, or sips of sugared drink (2 to 4 ounces per hour). **If you can't keep blood glucose above 80 mg/dL**, go to the nearest hospital Emergency Room right away. o **If blood glucose is 200 mg/dL or higher**, take the correction dose of insulin specified by your doctor.
Small ketones	0.6 to 1.5 mmol/l	o **If blood glucose is below 80 mg/dL**, have some hard candy, popsicles, or sips of sugared drink (2 to 4 ounces per hour) until blood glucose is above 200 mg/dL. o **When blood glucose is 200 mg/dL or higher,** take the correction dose of rapid acting insulin specified by your doctor. (If you're vomiting or unable to eat, decrease your dose of long-acting insulin by ½.) Take rapid-acting insulin every 3 to 4 hours until the urine ketones are normal or blood ketones are below 0.6 mmol/l. *Important: blood glucose MUST be above 200 mg/dL before extra insulin is taken.*
Moderate to large ketones	1.6 to 3.0 mmol/l	o **If blood glucose is below 80 mg/dL,** have some hard candy, popsicles, or sips of sugared drink (2 to 4 ounces per hour) until blood glucose is above 200 mg/dL. o **When blood glucose is 200 mg/dL or higher, take 1 ½ times the correction dose of rapid-acting insulin** specified by your doctor. (If you're vomiting or unable to eat, decrease your dose of long-acting insulin by ½.) Take rapid-acting insulin every 3 to 4 hours until the urine ketones are normal or blood ketones are below 0.6 mmol/l. *Important: your blood glucose MUST be above 200 mg/dL before extra insulin is taken.*
	- Above 3.0 mmol/l	**Go directly to the nearest hospital Emergency Room.**
Persistent vomiting, persistent diarrhea, and signs of dehydration (dry mouth, dry skin, no tears, little or no urination), difficulty breathing, orthostasis, change in mental status, chest pain[2]		**Go directly to the nearest hospital Emergency Room.**

****Mini-dose glucagon** rescue, using subcutaneous injections, is effective in managing children with type 1 diabetes during episodes of impending hypoglycemia due to gastroenteritis or poor oral intake of carbohydrate. Refer to Mini-Dose Glucagon Rescue for Hypoglycemia in Children With Type 1 Diabetes, Diabetes Care 24:643-645, 2001.

SCREENING, EVALUATION, AND DIAGNOSIS ALGORITHM



(a) Symptoms of diabetes

Early:
- polyuria
- polodypsia
- weight loss
- fatigue

Late:
- fruity breath
- vomiting
- abdominal pain
- Kussmaul repirations
- lethargy and confusion

(b) Criteria for screening for childhood type 2 diabetes:

1. Age 10 (or at onset of puberty if puberty occurs at a younger age) AND
2. Overweight: BMI ≥85% for age and sex, AND
3. Any 2 of these risk factors:
- **Family history** of type 2 diabetes in 1st or 2nd degree relative
- **High-risk race/ethnicity** (American Indian, African American, Hispanic, or Asian/Pacific Islander)
- **Signs of insulin resistance** or conditions associated with insulin resistance (acanthosis nigracans, hypertension, dyslipidemia, or polycystic ovarian syndrome (PCOS))

(c) Labs

All:
- Random Plasma Glucose (RPG)

If symptomatic only:
- Electrolytes, BUN, creatinine: to assess degrees of acidosis and dehydration
- Urine: dip for glucose and ketone—confirm with serum values ASAP

(d) BMI

BMI table available through Check Your Health at www.checkyourhealth.org

(e) Additional labs to help identify type 2 diabetes

These values are consistent with type 2 (reference range = ARUP labs):

- c-peptide: > 3.5 ng/mL
- GAD AB: < 1.25 U/mL
- IA-2 < 0.8 U/mL

INITIAL MANAGEMENT DECISIONS

Regardless of the type of diabetes, newly diagnosed children require immediate medical attention and education.

ISSUES TO CONSIDER

In all cases of type 1, for safe management, physicians must carefully weigh these factors as they decide where to treat these newly diagnosed pediatric patients:

- **Can I provide the appropriate level of medical care and monitoring?**
    - Level of monitoring dictated by the patient's condition
    - The patient's age, maturity, and family support
    - The physician's knowledge and skill in providing the necessary level of care— including initial insulin therapy and early adjustments

  About 30% of children newly diagnosed with diabetes present in **diabetic ketoacidosis (DKA)**, which can be life threatening (See information on following page).

DIABETIC KETOACIDOSIS (DKA) MANAGEMENT

Diabetic ketoacidosis (DKA) is the leading cause of morbidity and mortality in children with type 1 diabetes.[3] It's defined as a state of absolute or relative insulin deficiency resulting in hyperglycemia (blood glucose greater than 200 mg/dL) and metabolic acidosis from accumulation of ketoacids in the blood.[4] A child or adolescent in DKA (or ketosis) requires immediate medical attention. Use the algorithm below to guide clinical decisions—including the decision about the best site to deliver care.

For guidance in treating severe DKA with CNS involvement, call (801) 622-1000; ask for diabetes physician on call (Primary Children's Medical Center). DKA is a life-threatening condition, and never more so than in this circumstance.

DKA MANAGEMENT ALGORITHM

DKA (or ketosis) identified from patient evaluation
(pH <7.35, HCO_3<18)

Ketosis*
- pH: 7.3-7.35
- HCO3: 15-18
- urine ketones: small-large

Ketosis can usually be managed with **PO hydration** and **subcutaneous insulin.** Outpatient treatment is possible, but patients should usually be admitted for monitoring and education—especially if ketosis is present at diagnosis.
1. No IV necessary.
2. Bedside PG checks as outlined on page 15, and urine ketones checked with every void until normal.
3. No other labs, unless initial labs were abnormal or child is unable to eat.
4. Start on SC insulin per page 14 guideline.
5. Encourage intake of clear fluids that do not contain sugar.

Mild to moderate DKA*
- pH: 7.2-7.3
- HCO3: 10-15
- urine ketones: mod-large

May require **Intravenous fluids,** but may often be managed with **subcutaneous insulin**. Transfer as necessary to a facility that can provide the level of care and monitoring outlined below.
1. Give a 10-20 cc/kg bolus of NS or Ringer's lactate
2. If child looks well and is able to eat, continue IV fluids, usually 1.5 x maintenance ½ NS + 20-40 mEq/L KCl. No dextrose in IV fluids.
3. After bolus, recheck PG. If before a meal, start SC insulin (per page 14). If not, give short-acting insulin (0.1-0.2 U/kg) to cover the 4-6 hours until the next meal or dose.
4. Order PG checks and medical nutrition therapy as outlined on page 15.
5. Monitor electrolytes q 12-24 hours until normal.

Moderate to severe DKA*
- pH: <7.2
- HCO3: <10
- urine ketones: >10%

Required **IV volume expansion** and **IV insulin.** Transfer to a facility with a pediatric ICU, based on patient's needs (see below).

Consult, stabilize and transfer immediately to facility with a pediatric ICU if DKA with:
- o Clouded consciousness suggesting cerebral edema
- o Shock
- o Other organ involvement
- o Need for mechanical ventilation
- o Inotrope infusion

Note: Cerebral edema accounts for 57-87% of all DKA deaths—of which there were 2,000 nationwide in 2001.

Initiate treatment described below as able, even if awaiting transfer:

IV volume expansion: Often this volume expansion results in a substantial reduction in blood glucose level.
1. IV bolus of Ringer's lactate or NS: 10-20 ml/kg over the fist 1-2 hours.
2. Repeat only if there is evidence of cardiovascular instability (shock).
3. IV fluids, usually 1.5 x maintenance ½ NS + 20-40 mEq/L KCl.

IV insulin: Start after initial fluid bolus.
1. Repeat PG at bedside before starting insulin therapy.
2. Give insulin drip 0.1 units/kg/hr (25 U regular insulin in 250 ml NS). Aim is to reduce PG gradually (about 50-100 mg/dL/hr) to level of 150-250 mg/dL to prevent hypoglycemia or acute changes in osmolarity.
3. When the PG approaches 200 mg/dL, add dextrose to the IV fluids (D10).
4. Titrate the dextrose concentration in the IV fluids to 12% dextrose as required to maintain PG level between 150 and 250 mg/dL.
5. Except for situation of true hypoglycemia, do NOT decrease insulin below 0.08 U/kg/hr until the acidosis is resolved (bicarb >15, pH >7.3, since insulin is required to prevent ketogenesis and correct the acidosis.

Note: Patient's laboratory values may continue to deteriorate for the first 2 to 4 hours after treatment is initiated. But if patient is not improved by 6 to 8 hours after beginning treatment, transfer immediately to facility with PICU.

Once stabilized, move to Type 1 Management (page)

Precipitating factors

- **Isolated DKA episode(s)** caused by missed insulin injections, infection, and failure to adjust insulin dosage when needed.
- **Recurrent DKA** caused by missed insulin injections. Patients with this condition have a higher incidence of psychiatric illness especially depression.

* Because primary care providers may have limited access to experienced pediatric specialists, the values recommended here for treatment stratification are more conservative than those in the ADA's 2005 statement on type 1 management.

TYPE 1 MANAGEMENT

ISSUES TO CONSIDER

- **Starting insulin doses for children and adolescents are based on body weight,** and must be adjusted based on individual response and plasma glucose levels over the first several weeks
- **Recognizing hypoglycemia in children can be difficult** and depends on the child's age, cognitive abilities, and communication skills
- **Tight control must be carefully balanced with the risk of hypoglycemia**
    - Mild to moderate hypoglycemia symptoms include: sweating, pallor, palpitations, tremors, headache, behavioral changes, neuroglycopenia
        - Treatment: 15 grams of easily absorbable carbohydrates, wait 15 minutes and test blood
    - Severe Hypoglycemia symptoms include: Altered state of consciousness
        - Treatment: Glucagon emergency kit or intravenous glucose
- **The "honeymoon period."** During this time the pancreas may still secrete some insulin. Over time, this secretion stops and as this happens, the child will require more insulin from injections. The honeymoon period can last weeks, months, or even up to a year or more.
- **The onset of puberty can significantly alter insulin needs and participation in self-management.** Management must therefore include developmentally appropriate education, with an emphasis on transition to adult diabetes care, and screening for long-term complications
- **Education must be tailored to the developmental stage of the patient**—and include parents or other caregivers

INSULIN OVERVIEW

Comparative profiles

Insulin type (description of solution) and notes on use	generic (Brand) name	Onset*	Peak*	Max duration*	2005 30-day avg. wholesale $
Rapid-acting (clear) Since the onset of action for rapid-acting insulin is 5-15 minutes, it should be given just before eating. To avoid cumulative action when using a correction for high glucose levels, this type of insulin should NOT be given more often than every 3 hours. Waiting for blood glucose levels to come down is safer than risking hypoglycemia.	aspart (NovoLog) lispro (Humalog)	5-15 min	45-90 min	3-5 hrs	10 ml: $81
Intermediate-acting (cloudy) The dose of intermediate-acting insulin does not vary with blood glucose level. Use of this type of insulin requires that the child eat a consistent amount of carbohydrate at a consistent time (e.g., 60 grams at 12 noon for lunch).	NPH (Novolin N) NPH (Humulin N)	1-3 hrs	4-12 hrs	12 to 24 hrs	10 ml: $35
Long-acting (clear) Long acting insulin has a more sustained, stable activity curve and substantially less peak than rapid- or intermediate-acting insulin; its duration of action is 12 to 24 hours (once to twice daily injections). It should be given SC only; NOT administered IV. Additional injections of short-acting insulin are required to cover food intake. Note that long-acting insulin should not be diluted or mixed with any other insulin solution.	glargine (Lantus) detemir (Levemir)** ***Per product labeling, detemir should be dosed twice daily in pediatric population*	1-2 hrs 2-4 hrs	None 6-8 hrs	24 hrs < 18 hrs	10 ml: $70

***Note**: Information in this table derives from manufacturer prescribing information and results from independent studies. The time course of action of any insulin may vary considerably in different individuals, and may also vary based on such factors as dose, site of injection, temperature, and physical activity. In children and adolescents, absorption maybe different.

TYPE 1 INITIAL MANAGEMENT: INSULIN THERAPY AND SURVIVAL EDUCATION

Both insulin therapy and patient/family education must begin immediately after diagnosis.

Type 1 confirmed or suspected
In some cases, may begin therapy while awaiting result of lab to confirm type

Initiate INSULIN THERAPY based on age of child

Toddler and preschoolers (<6 years)

Long-acting + Rapid-acting
- Long acting: 0.3-0.4 unit/kg/day at breakfast

+

- **Rapid-acting:**
  - Before meals: ½ unit per 15-20 grams carbs
  - As correction dose: ½ unit per every 50 mg/dL over 200 mg/dL *(example: If pre-meal blood glucose is 300 mg/dL, take unit NovoLog)*

Comments about this regimen

Young children, especially toddlers, are notorious "grazers" who rarely eat regular meals. These children may do best with long-acting insulin.
- Long-acting insulin dose may be slightly higher as a % of the total daily dose to cover frequent intake of small amounts of carbohydrate (necessary because of erratic eating patterns).
- Rapid-acting can be used more as a "correction dose" to bring glucose down if it's over 200 mg/dL, rather than as a "carb dose" to cover anticipated carb intake.

School-age children (6-12 years)

Adolescents and younger adults (13-19 years)

Long-acting + Rapid-acting
- Long acting: 0.4 to 0.6 unit/kg/day at bedtime

+

- **Rapid-acting:**
  - Before meals and snacks: 1 unit per 10-20 grams carbs
  - As correction dose: 1 unit per every 50 mg/dL over 150 mg/dL *(example: If pre-meal blood glucose is 250 mg/dL, take 2 units NovoLog)*

Comments about this regimen

Pre-teens and teens (over the age of 12) usually want more flexibility in the meal timing and amount. If they can calculate insulin dosing and give themselves an injection, this regimen provides more flexibility. The same applies to younger children, provided they have enough support for the lunch-time shot.

Note that the long-acting insulin is a pure basal or background insulin. Rapid-acting insulin MUST be taken before ALL meals and snacks to have good control. (Unlike toddlers, older children—especially adolescents—eat too many carbs at a time to expect adequate coverage with long-acting insulin alone.)

AND

Initiate EDUCATION
- See information on page 9
- **Focus on the following information and skills:**
  - **SMBG** (self-monitoring of blood glucose) and record keeping
  - **Insulin** injections, storage, dosing
  - **Instructions for home management** of hypoglycemia, hyperglycemia, sick days

Refer for MEDICAL NUTRITION THERAPY (MNT)

Dietitian should provide meal plan that approximates the patient's normal eating patterns AND considers insulin regimen, for example,

Meal Plan for users of intermediate-acting insulin:
- 3 meals, 2-3 snacks, at scheduled times (note that toddlers often eat the same amount of carbohydrate at meals and snacks—thus their meal plans should accommodate 6 small meals in a day, rather than 3 larger meals + 2-3 smaller snacks_
- Kcal needed per age

Meal plan for users of long-acting insulin:
- Eat to satisfy hunger
- Dose rapid-acting insulin to carbohydrate intake EVERYTIME child eats (except for toddlers)
- Toddlers may not need carbohydrate dosing initially, especially if grazing

Monitor growth and evaluate carbohydrate / caloric needs

EARLY ADJUSTMENTS: INSULIN AND MEDICAL NUTRITION THERAPY

For the first several months of treatment, providers should expect to adjust initial therapy based on the patient's response, changing needs (especially with respect to the "honeymoon" phase**), and a growing understanding of how the patient and family live with and manage diabetes.

Diagnosis to 2 weeks

Insulin adjustment

Monitor BG at these times:
- Before meals (fasting blood glucose, or FBG)
- Before bedtime snack
- As needed, with symptoms of hyper- or hypoglycemia (e.g., irritability, shakiness, sleepiness)
- For first 3-5 days after diagnosis, ALSO monitor at 2:00 AM

If FBG is <80 mg/dL; give 15 grams extra carbohydrate with the meal. Reduce evening long-acting insulin by 0.5-1.0 u

If BG before bedtime snack is…
- 80-100 mg/dL: give extra carbohydrate
- <80 mg/dL: give extra 30 grams carbohydrate before bed, recheck in 2 hours, and treat again if still low
- Change dinner dose by 1.0 u

If BG at 2:00 AM is:
- High (>200 mg/dL), adjust the NEXT DAY's dose
- Low (<100 mg/dL), give 30 grams of carbohydrate, recheck in 1-2 hours, and continue to treat/re-check until BG is ≥100 mg/dL

Review SMBG records every 1-2 days for 2 weeks

Medical nutrition theraphy

Set up a meal plan using calorie levels below, matching as closely as possible the patient's/family's normal eating habits and patterns.

Age	Calorie level	Average grams of carbohydrate/meal
0-1 years	1,000	22
1-2 years	1,200	30
3-5 years	1,500	37-45
6-7 years	1,600-1,800	45-60
8-9 years (and teen girls)	1,800-2,000	60-75
10-12 years (and teen girls)	2,000-2,200	60-75
Boys 13-15 years	2,200-2,500	75-90
Boys 15-19 years	2,500-2,800	90-105
Active boys 15-19 years	2,900-3,000	105-120
Very active boys 15-19 years	3,000-3,100	105-120
Super active boys 15-19 years	3,100-3,300	120-135

Follow-up with the patient and family within the first 2 weeks to make adjustment as needed.

Due to their excessive hunger in the first few days after diagnosis, it's common for children newly diagnosed with diabetes to overestimate how much they regularly eat. For this reason, the meal plan often needs to be cut down at this point.

Due to the variability among age groups, it is hard to determine insulin to carbohydrate ratio

2 weeks to 2 months after diagnosis

Adjust insulin, up or down, 5-10% to target BG*
- When adjusting, anticipate the "honeymoon": phase** and consider the family's skills and the patient's ability to percieve blood glucose lows.
- Continue to review SMBG records every 1-2 weeks (can be done by fax/phone/email).

Rapid-acting:
- Use lunch BG to adjust AM rapid-acting; increase 0.5 to 2.0 units (5-10%) to target lunch BG.
- Use dinner BG to adjust rapid-acting insulin.
- Use bedtime BG to adjust dinner rapid-acting insulin; increase 0.5-2.0 units (5-10%) to target bedtime BG.

Long-acting:
- Use FBG to adjust evening long-acting insulin (adolestcents) increase 0.5-1.0 unit per day to taget FBG.

***Target BG based on age (type 1)**

	HbA1c	BG before meals	BG bedtime/ overnight
Age < 6yr	7.5-8.5%	100-180 mg/dL	110-200 mg/dL
Age 6-12 yr	<8%	90-180 mg/dL	100-200 mg/dL
Age 13-19 yr	<7.5%	90-130 mg/dL	90-150 mg/dL

****"Honeymoon" phase:**
within a few days to 2 weeks of initiation of insulin therapy, there is a transient phase in which endogenous insulin secretion improves. Clinically, this results in excellent control of blood glucose on a relatively low dose of insulin, with little variability in a day-to-day glucose values. This "honeymoon" phase can last from weeks to months; it ends gradually with increasing blood glucose and increasing insulin requirement.

TYPE 2 MANAGEMENT

ISSUES TO CONSIDER

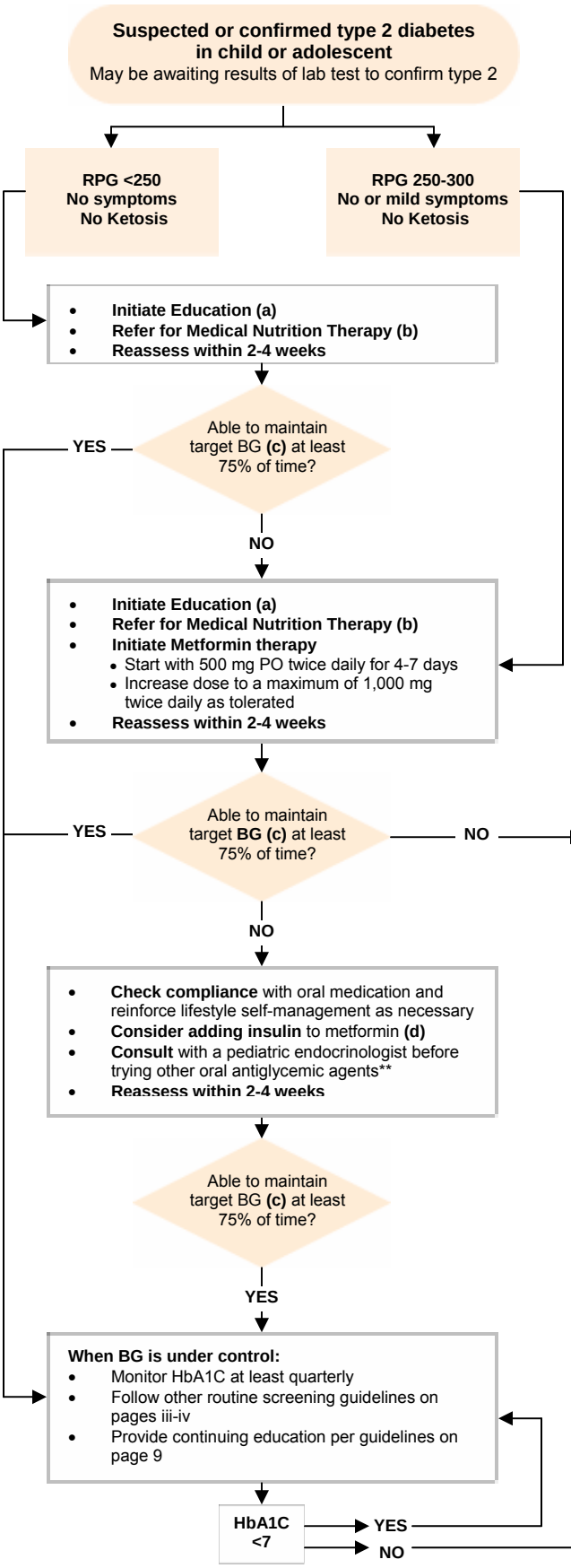
- **Confirming type**
- **Lifestyle modification.** Diet, exercise, weight loss, cultural background, and family intervention are central components of self-management for most children and adolescents with type 2.
    - Inquire if patients are using complementary alternative medicines that may affect adherence to their prescribed medications.
- **Oral medications**
- **Insulin therapy**. For patients who cannot achieve glycemic control with lifestyle modification and oral medication, insulin may be appropriate.
- **Consultation** with an endocrinologist is recommended (for older teens, it may be more convenient to see an adult endocrinologist.

ORAL MEDICATION SUMMARY

Generic Name	Brand Name	Usual Dosing	2005 AWP Cost for 30 day supply	Pros	Cons
Metformin	Glucophage	500 mg once daily (start) to 1000 mg twice daily	**Generic:** 500 mg once daily $10.50 1000 mg twice daily $55 **Brand Name:** 500 mg once daily $27 1000 mg twice daily $110	▪ Decreases the risk of weight gain (preferred for obese patients–most with type 2 diabetes) ▪ Favorable lipid effects ▪ No hypoglycemia ▪ Maximum BG effect at 3-4 weeks	▪ GI distress (nausea/diarrhea) ▪ **CAUTION**– Increased risk of acidosis: ○ **Stop medication** with acute illness, dehydration, or IV contrast dyes ○ **Do not** use for patients with CHF, chronic liver disease, history of alcohol abuse, or renal failure ▪ **BE AWARE** that Metformin may increase pregnancy risk and should NOT be initiated during pregnancy. o If Metformin had been used prior to pregnancy in a woman with Polycystic Ovary Syndrome (PCOS). it may be continued in order to lessen the risk of GDM
	Glucophage XR	500-1000 mg @ once daily with food	500 mg once daily $27 1500 mg once daily $82		

Note: Metformin is the only oral hypoglycemic agent that has been reliably studied and used with children and adolescents, and therefore is the only oral agent FDA-approved for use in this population. There are anecdotal reports of successful use of other oral hypoglycemic agents in pediatric populations, but consultation with a pediatric endocrinologist is recommended before they are prescribed.

TYPE 2 MANAGEMENT ALGORITHM



(a) Initiates EDUCATION

Education for type 2 has a particular focus on lifestyle and self-management. Education should include the following.

- **Teach SMBG** (self-monitoring of blood glucose) and record keeping.
- **Provide instructions for home and school** for hyperglycemia, intercurrent illness.
- **Develop personal exercise plan**

(b) Refer for MEDICAL NUTRITION THERAPY (MNT)

Medical Nutrition Therapy for type 2 should be done by a dietitian who has experience with pediatric patients. Dietitian should provide meal plan to support weight loss (if necessary) as well as control glucose, lipids, and blood pressure levels.

(c) Target BG based on age (type 2) on Oral Hypoglycimics (OHA)

	HbA1C*	BG before meals	BG bedtime/ overnight
Age 6-12 yr	<7.0%	90-180 mg/dL	100-200 mg/dL
Age 13-18 yr	<7.0%	90-130 mg/dL	90-150 mg/dL

*This HbA1C (<7.0%) was chosen specifically for children on OHA. In the experience of the committee, most children will quickly require insulin and consequently a lower A1C was selected in order to facilitate management.

HBA1C should be as low as possible without risking significant hypoglycemia

(d) Guidelines for adding insulin to metformin

Initially, the addition of once daily long-acting insulin to metformin may provide control. A starting dose of 5-10 units SC at bedtime can be used (0.1-0.2 u/kg/day). The dose should be titrated up every 3-4 days based upon that fasting blood glucose is in target and the rest of the glucose values during the day are high, then rapid-acting insulin (pre-meal) should be added next.

**Only Metformin and insulin have been reliably studied and used in children and adolescents. Although there are anecdotal reports of successful use of other antidiabetic agents in pediatric patients, if patients fail to respond to these outlined therapy guidelines, a pediatric endocrinologist should be consulted prior to initiating therapy with other agents. In rural areas, consultation with any endocrinologist may be a more accessible option.

EDUCATION

It is important that education be provided immediately after patient is diagnosed with diabetes. The patient and family members must acquire skills necessary to manage day-to-day events with diabetes. Personalize each of the following points to the individual and their family.

- Patients and families must know the impact of lifestyle decisions on the risk for long-term complications
    - Families may have issues that could possibly affect the overall management of the child's diabetes
- People with diabetes have a risk for mental health disorders
- Provide anticipatory guidance for issues that may affect self-management and treatment
    - Beginning school, entering puberty, avoiding smoking and substance abuse, etc
- Address nutritional concerns
    - Proper diet, weight management, eating disorders, etc
- Updates on new technology
    - Pumps, meters, and types of insulin, etc
- Updates on new research
- Importance of optimizing blood glucose, lipid, and blood pressure treatment
- Patients should carefully prepare for surgery or dental procedures
- Pregnancy is always high-risk with diabetes (refer to the UDPR Section 2: Diabetes in Pregnancy)
- To obtain a driver's license in most states, people with diabetes need a medical evaluation and completed evaluation form attesting to their ability to drive

It is not safe management to send a pediatric patient newly diagnosed with diabetes home with medication only—without this education. It is recommended that individuals with diabetes participate in Diabetes Self-Management Education (DSME) classes. As children and adolescents may need assistance in their goal of independence, family members or caregivers are encouraged to participate in these classes as well.

The following is a list of Utah facilities that offer pediatric diabetes education:

- **Castle View Hospital – Price, UT**
  435-637-4800
- **Dixie Regional Medical Center – St. George, UT**
  435-688-3408
- **Primary Children's Medical Center – Salt Lake City, UT**
  801-587-3999
- **Utah Valley Regional Medical Center – Provo, UT**
  801-357-7546
- **Mountain View Hospital – Payson, UT**
  801-465-7045
- Darryl Clarke, MD – Logan, UT

For ADA and State certified programs:
http://www.health.utah.gov/diabetes/pdf/udpr/udp_dsmelistexcerpt_nov06.pdf

EDUCATION PLAN
Patient and family must demonstrate proficiency at self-management.

First 3 days:

Pathophysiology of diabetes. Basic only, sufficient as context for self-management.

SMBG (self-monitoring of blood glucose) and ketone testing. Hands-on training in using a blood glucose meter, checking for ketones.

Insulin and/or other medication therapy. "How-to" information re: insulin injections, syringe disposal, glucagon use, and medication schedule, and insulin storage.

MNT (Medical Nutrition Therapy). Basic, sufficient to allow self-management at home.

Hypoglycemia, hyperglycemia, and **intercurrent illness.** "How-to" information on recognizing and treating high/low blood glucose, and self-care on a sick day.

Within 5 to 14 days:

Re-assess and provide additional support for all basic self-management skills listed above: SMBG, insulin use, etc.

Provide more in-depth MNT as needed to promote lifestyle changes, add flexibility, and improve medication therapy.

Help develop individualized plans for school and daycare management, and counsel families about how to help other caregivers implement these plans

Offer reference information for local and national resources

MANAGEMENT AT SCHOOL AND DAYCARE

- **Help families complete an individualized Diabetes School Care Plan within 2 weeks of diagnosis.**[5] Form available at this Utah Department of Health website: health.utah.gov/diabetes/pdf/forms/geninfocareplan-October 2003.pdf

- **Encourage parents to meet with all teachers, caregivers, etc**. to provide information contained in the Utah Department of Health's information sheet, What School Personnel Should Know About the Student with Diabetes.[6] Form available at this Utah Department of Health website: health.utah.gov/diabetes/pdf/forms/geninfo-October 2003.pdf

- **Instruct families to assemble "low blood glucose treatments kits"**. Such a kit should include:
    - Information sheet: What School Personnel Should Know About the Student with Diabetes (see above)
    - Extra Blood Glucose Meter (to be left at school)
    - Fast-acting carbohydrates to use during lows, e.g., juice boxes or glucose gel or tabs
    - Glucagon kit with instructions

- **Psychosocial issues** play a large part in the lives of maturing children and adolescents. During this maturing stage of life, children and adolescents need to be properly educated on how to handle peer pressure and the dangers of smoking, drugs, and alcohol consumption.

- **For more information on the management of diabetes while at school:** http://www.health.utah.gov/diabetes/resourcesmain/glucagon.htm **or** http://www.diabetes.org/for-parents-and-kids/for-schools.jsp

RESOURCES

CONSULTATION

- **For urgent situations** any time of the day or night, phone the diabetes physician on call at Primary Children's Medical Center: (801) 662-1000.
- **For non-urgent situations** during normal work hours, phone the Primary Children's Diabetes Program at the Utah Diabetes Center, (801) 662-1000 to speak with a nurse educator.

LOCAL DIRECTORY

- **Utah Diabetes Directory** can be downloaded at http://health.utah.gov/diabetes/pdf/programmaterials/professionalresource05.pdf

REFERENCE

Organization	Website
American Diabetes Association	www.diabetes.org
Children with Diabetes	www.childrenwithdiabetes.org
Joslin Diabetes Center	www.joslin.org
Juvenile Diabetes Research Foundation	www.jdrf.org
Foundation for Children and Youth with Diabetes (camp)	www.fcyd-inc.org
Barbara M. Davis Center for Childhood Diabetes	www.barbaradaviscenter.org
National Institutes of Health (NIH): • National Institute of Diabetes and Digestive and Kidney Diseases • National Diabetes Education Program	Primarily for physicians: niddk.nih.gov Primarily for patients: diabetes.niddk.nih.gov For school/daycare personnel —as well as patients and families: www.ndep.nih.gov/resources/school.htm
Utah Diabetes Prevention & Control Program	www.health.utah.gov/diabetes

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